

Selected FETC Engine and Combustion Publications

FETC In-House Reciprocating Engine Selected Publications

Richards, G.A., McMillian, M.H., Gemmen, R.S., Rogers, W.A., and Cully, S., "Issues for Low-Emission, Fuel Flexible Power Systems," *Progress in Energy and Combustion Science.*, (In Review), 1999.

McMillian, M.H., Gautam, M., "Considerations for Fischer-Tropsch Derived Liquid Fuels as a Fuel Injection Emission Control Parameter," *SAE Paper*, 982489

McMillian, M.H., Robey, E.H., Cully, S.R., and Addis, R.E., "Pilot Chamber Combustion in a Coal-Fueled Diesel Engine," *Presented at the Energy Sources Technology Conference and Exhibition*, New Orleans, LA, January 1994.

Romero, C.E., Morris, G., and McMillian, M.H., "Autoignition of Low-Heating Value Gases in a Direct-Injected Diesel Engine," *Combustion Science and Technology*, Vol. 96, pp 369-385, 1994 (received August 1992).

Romero, C.E., Liese, E., and McMillian, M.H., "Ignition Delay of Low-BTU Gases in a Simulated Direct-Injected Diesel Engine Environment: Modeling," *Presented at the 15th Energy Sources Technology Conference and Exhibition*, Houston, TX, January 1992.

McMillian, M.H. and Robey, E.H., "Preliminary Tests of Fuel-Bound Nitrogen Conversion Using Nitrogen-Doped Diesel Fuel in a Single-Cylinder Diesel Engine," *Presented at the 14th Annual Energy Sources Technology Conference and Exhibition*, Houston, TX, January 1991.

Zhong, B.Z., Keane, M.J., Wallace, W.E., McMillian, M.H., Ong, T., Comparative Genotoxicity of Diesel Emission Particulate Extracts for Conventional and Coal-Derived Fuel Use , *Envir. Molec. Mutagenesis* 17(19):80.

McMillian, M.H. and Webb, H.A., "Coal-Fueled Diesels: Systems Development," *Journal of Engineering for Gas Turbines and Power*, Vol. 111, July 1989 (received August 1988).

Williams, M.C., Holcombe, N.T., and McMillian, M.H., "Environmental Aspects of Coal-Fueled Diesel Engines," *Journal of Engineering for Gas Turbines and Power*, Vol. 111, July 1989 (received October 1988).

Webb, H.A., Rekos, N.F., and McMillian, M.H., "Overview of the Department of Energy's Heat Engines Program," *Presented at the 16th Energy Technology Conference*, Washington, D.C., February 1989.

Rao, A.K., Wilson, R.P., Balles, E.N., Mayville, R.A., McMillian, M.H., and Kimberly, J.A., "Cooper Bessemer Coal-Fueled Engine System - Progress Report," *Presented at the 12th Annual Energy Sources Technology Conference and Exhibition*, Houston, TX, January 1989.

FETC Sponsored Conference - Papers

McMillian, M.H., Romero, C.E., Robey, E.H. and Benedict, D.A., "METC In-House Coal-Fueled Diesel Research: Overview," Heat Engines and Gas Stream Cleanup Contractors Review Meeting, July 1991.

Wallace, W.E., Ong, T., Keane, M.J., Zhong, B.Z., Hochberg, V., Gu, Z.W., McCawley, M., Harrison, J., McMillian, M., Respirable Exhaust Emissions for Coal-Fueled Diesels , Heat Engines and Gas Stream Cleanup Contractors Review Meeting, July 1991.

FETC Sponsored Conferences - Poster Session Papers

McMillian, M.H., Robey, E.H., and Addis, R.E., "METC Research on Coal-Fired Diesels," METC Joint Contractors Review Conference, Morgantown, WV, August 1993.

Halow, J.S., and McMillian, M.H., "METC Combustion Research Facility," METC Heat Engines Contractors Review Meeting, October 1992.

McMillian, M.H., Richardson, S.W., Robey, E.H., and Romero, C.E., "METC Research on Coal-Fired Diesels," METC Heat Engines Contractors Review Meeting, October 1992.

FETC Internal Information Reports

McMillian, M.H. and Benedict, D.A., "Twin-Armed Crankshaft for Increased Dwell Time in Coal-Fueled Diesel Engines", METC II 2749, May 1991.

Patents

"Coal-Water Slurry Fuel Internal Combustion Engine and Method for Operating Same," U.S. Patent No. 5,163,385, November 17, 1992. Inventor: Michael H. McMillian, Fairmont, WV.

Other FETC In-House Related Documents

Ayers, W.J., Strickland, L.D., Leep, J.R. and Wojewodka, R.A., "Diesel Engines Liquid Fossil Fuels, A Scoping Study, " *Presented at the Annual Coal Fuel Heat Engines and Gas Stream Cleanup System Contractors Review Meeting*, June, 1988.

Crouse, F.W., Jr., "*Proceedings of the 1st annual Heat Engines contractors Review Meeting*," Report No. DOE/METC/84-31, November 1984.

Carpenter, L.K., and Crouse, F.W., Jr., "Coal-Fueled Diesels, Fossil Energy Activities," *Presented at the 1985 ASME Energy Sources Technology Conference/Diesel and Gas Engine Symposium*, Paper 85-DGP-18, February 1985.

Carpenter, L.K., and Crouse, F.W., Jr., "Coal-Fueled Diesels, Progress and Challenges,"

Presented at the 1986 ASME Energy Sources Technology Conference/Internal Combustion Engine Symposium, Paper 86-ICE-6, February 1986

Recent (since 1995) Selected papers from FETC In-House combustion research:

Issues for Low-Emission, Fuel-Flexible Power Systems (1999).

G. A. Richards, M. H. McMillian, R. S. Gemmen, W. A. Rogers, and S. Cully, *Progress in Energy and Combustion Science.*, in review.

Frequency Response of Bodies with Combined Convective and Radiative Heat Transfer (1999).

M. A. Hadley, G. J. Morris, G. A. Richards, and P.C. Upadhyay. *International Journal of Heat and Mass Transfer*, to appear.

Active Control of Flame Oscillations with Equivalence Ratio Modulation (1999).

G. A. Richards, M. C. Janus and E.H. Robey. *AIAA Journal of Propulsion and Power*. Vol 15, No.2, pp 232 – 240.

Heat Capacity and Thermal Conductivity Considerations for Coal Particles During the Early Stages of Rapid Heating (1999). Maloney, D., Sampath, R., and Zondlo, J. *Combustion and Flame*. Vol. 116, p. 94.

Characterization of Oscillations During Premix Gas Turbine Combustion (1998).

G. A. Richards and M.C. Janus.). *ASME Journal of Engineering for Gas Turbines and Power*. Vol. 120 pp. 294 - 302.

Evaluation of Thermophysical and Thermochemical Heat Requirements for Coals at Combustion Level Heat Fluxes (1998). Sampath, R., Maloney, D., and Zondlo, J. *in Twenty-Seventh Symposium (International) on Combustion*, The Combustion Institute, 1998, p. 2915.

A Test Device for Gas Turbine Combustion Oscillations (1997).

G. A. Richards, R. S. Gemmen, M. J. Yip (1997). *ASME Journal of Engineering for Gas Turbines and Power*. Vol. 119, pp. 776 - 782.

An Analytical Approach to Understanding the Pressure-Gain Combustor (1997).

M. C. Janus, G. A. Richards, R. S. Gemmen and E. K. Johnson. *ASME Journal of Energy Resources and Technology*, Vol. 119, pp. 49-54.

Combustion Oscillation Control by Cyclic Fuel Injection (1997).

G. A Richards, M. J. Yip, E. Robey, L. Cowell, and D. Rawlins. *ASME Journal of Engineering for Gas Turbines and Power*, Vol 119, pp. 340-343.

Chaos in Thermal Pulse Combustion (1995).

C.S. Daw, J.F. Thomas, G. A. Richards and L. L. Narayanswami. *Chaos: An Interdisciplinary Journal of Nonlinear Science*, Vol. 5, No. 4, pp. 662 - 670.

Pressure-Gain Combustion, Part I, Model Development and Mixing Effects (1996).

L. L., Narayanaswami and G. A. Richards. *ASME Journal of Engineering for Gas Turbines and Power*, Vol. 118, pp. 461-468.

Pressure-Gain Combustion, Part II, Experimental and Model Results (1996).

G. A. Richards and R. S. Gemmen. *ASME Journal of Engineering for Gas Turbines and Power*, Vol 118, pp. 469-473.

Measurement of Coal Particle Shape, Mass, and Temperature Histories: Impact of Particle Irregularities on Temperature Predictions and Measurements (1996). Sampath, R., Maloney, D., Zondlo, J., Woodruff, S., and Yeboah, Y. in *Twenty-Sixth Symposium (International) on Combustion*, The Combustion Institute, 1996, p. 3179.

Thermal Pulse Combustion (1995).

G.A. Richards, G.J. Morris, D.W. Shaw, S.A. Keely, M.J. Welter, *Combustion Science and Technology*, Vol. 94, pp. 75-85.

Patents from FETC In-House combustion research:

Pulse Combustor with Controllable Oscillations (1992).

G. A. Richards, G. J. Morris, M. J. Welter, U. S. Patent No. 5,123,835.

Combustor Oscillating Pressure Stabilization and Method (1998).

R. S. Gemmen, G. A. Richards, M. J. Yip, E. H. Robey, S. R. Cully, R. E. Addis, U. S. Patent 5,791,889.

Combustor Oscillation Attenuation Via the Control of Fuel-Supply Line Dynamics (1998).

G. A. Richards, R. S. Gemmen, U. S. Patent 5,809,769.

FETC In-House CRADA Agreements and Reports:

United Technologies Research Corporation, East Hartford, CT. (In progress) Investigating HAT-cycle low NOX technology for gas turbines.

Solar Turbines, Inc., San Diego, CA. CRADA Agreement 94-022 (Completed). Produced three reports and patent filed for a practical method of “active” combustion control . Completed first full-engine test.

Solar Turbines, Inc., San Diego, CA CRADA Agreement 98-F021 (Completed). Produced one report of second full-engine tests of FETC-Solar active combustion control; assessment for further development in progress.

Parker Hannifin, Cleveland, OH. CRADA Agreement 98-F010. (In progress) Developing dual-fuel low-emission combustion.

Energy Research Corporation, Danbury, CT. CRADA Agreement 96-040. (In progress). Developing a catalyst-free fuel cell anode exhaust oxidizer.

Alzeta Corporation, Santa Clara CA., CRADA Agreement 96-038 (Completed). Completed tests demonstrating the potential of surface stabilized combustion for low-emissions.

Alzeta Corporation, Santa Clara CA., CRADA Agreement 98-F019. Completed testing of a full-scale surface stabilized turbine combustor.

Selected Conference articles from FETC In-House Combustion Research

Technical Development Issues and Dynamic Modeling of Gas Turbine and Fuel Cell Hybrid Systems (1999) Liese, E. A., Gemmen, R. S., Jabbari, F. , and Brouwer, J. To be presented at ASME TurboExpo, June 1999, Indianapolis, IN.

Effect of Axial Swirl Vane Location on Combustion Dynamics (1999). Straub, D. L., and G. A. Richards

To be presented at ASME TurboExpo, June 1999, Indianapolis, IN.

An Experimental and Modeling Study of Humid Air Premixed Flames (1999). Bhargava, A., Colket, M., Sowa, W., Casleton, K., and Maloney, D. To be presented at ASME TurboExpo, June 1999, Indianapolis, IN.

Importance of Axial Swirl Vane Location on Combustion Dynamics for Lean Premixed Fuel injectors (1998). AIAA paper 98-3909.

Oxidation of Low Calorific Value Gases - Applying Optimization Techniques to Combustor Design (1998). Gemmen, R. S., FACT-Vol. 22, 1998 International Joint Power Generation Conference, Vol. 1, pp. 259 - 266. ASME 1998.

A Partial Oxidation Technique for Fuel-Cell Anode Exhaust Gas Synthesis (1998) Gemmen, R.S. and E.H. Robey, DOE/FETC-98/1071.

Effect of Fuel Nozzle Configuration on Premix Combustion Dynamics (1998)
D. L. Straub and G. A. Richards. ASME paper 98-GT-492 .

A Cold-Flow Experimental and Numerical Study of Fuel Injector Nozzle and Combustion Chamber Dynamics with Swirl and Non-Swirl Flows (1998). M. J. Yip, D. L. Straub, G. A. Richards, W. A. Rogers, Proceedings of the 1998 International Joint Power Generation Conference, Baltimore MD, August 24 – 26, FACT-Vol. 22.

Effects of Ambient Conditions and Fuel Composition on Combustion Stability (1997).

M. C. Janus, G. A. Richards, M. J. Yip, and E. H. Robey. ASME paper 97-GT-266.

Results of a Model for Premixed Combustion Oscillations (1996), M. C. Janus, G. A. Richards, Presented at the 1996 American Flame Research Committee International Symposium, Sept 30 - October 2, Baltimore, Maryland.

A Model for Premixed Combustion Oscillations (1996), M. C. Janus, G. A. Richards, Technical Note, DOE/METC-96/1026 (DE96004366).

Combustion Oscillation Control: Chemical Control Showing Mechanistic Link to Recirculation Zone Purge Time (1995), R. S. Gemmen, G. A. Richards, M. J. Yip, T. S. Norton, Presented at the Eastern States Section Meeting of the Combustion Institute, Worcester, MA October 16- 18, 1995.

Design Factors for Stable Lean Premix Combustion (1995), G. A. Richards, M. J. Yip, R. S. Gemmen, Proceedings of the 1995 Advanced Turbine Systems Annual Program Review Meeting, DOE/METC-96/1023 (DE960000561).